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EXAMINER	
TORRES, JOSE	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/697,132	WANG, XIANGLIN	
	Examiner	Art Unit	
	Jose M. Torres	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 February 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,11-13,15-17,25 and 26* is/are rejected.

7)☒ Claim(s) *4-10, 14, 18-24 and 27-28* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Comments

1. The Amendment filed on February 28, 2007 has been entered and made of record.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ott et al. (US 4,853,970) in view of Hannah (US 5,712,682).

As to claims 1 and 15, Ott et al. teaches a method/system for detail enhancement for an original image signal represented by a set of pixels (Col. 1 lines 8-16), comprising the step of: (a) detecting/detector (FIG. 1, "edge operator module **14**") image pixels that belong to a luminance transition range of an image edge (Col. 6 lines 7-22).

However, Ott et al. does not explicitly disclose (b) generating/generator gain suppression factors for the detected pixels in the luminance transition range of the image edge; and (c) performing image detail enhancement/detail enhancer on the image pixels while selectively reducing enhancement of the detected image pixels in the

luminance transition range relatively to enhancement of other image pixels based on the gain suppression factors.

Hannah teaches (b) generating/generator gain suppression factors (FIG. 2, "gain control amplifier **106**" and FIG. 3, "step **122**") for the detected pixels in the luminance transition range of the image edge (Col. 4 lines 54-65); and (c) performing image detail enhancement/detail enhancer (Reception of gain performed by the gain control amplifier.) on the image pixels while selectively reducing enhancement of the detected image pixels in the luminance transition range relatively to enhancement of other image pixels based on the gain suppression factors (FIG. 7C, Col. 8 lines 11-22).

Therefore, in view of Hannah, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ott et al.'s method by incorporating the gain settings, as taught by Hannah, and apply them to the transition regions, where theses specified regions receive little or no gain at all compared with other pixels within the image in order to increase the image detail and improving the overall image quality (Col. 2 lines 34-41).

4. Claims 2, 3, 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ott et al. in view of Hannah as applied to claims 1 and 15 above, and further in view of Nagao (US 6,628,842). The teachings of Ott et al. modified by Hannah have been discussed above.

As to claims 2 and 16, Ott et al. modified by Hannah fails to teach selecting enhancement gain factors for the image pixels; and combining the gain suppression

factors with the corresponding enhancement gain factors to obtain adjusted gain factors; wherein the steps of performing image detail enhancement further includes the steps of performing image detail enhancement on the image pixels based on the adjusted gain factors to selectively reduce enhancement of the detected image pixels in the luminance transition range of the edge.

Nagao teaches selecting enhancement gain factors for the image pixels ("scaling parameter α", Col. 19 lines 10-32); and combining the gain suppression factors ("blur retaining but sharpness enhancing coefficient $C_{BS}(x,y)$") with the corresponding enhancement gain factors to obtain adjusted gain factors (Col. 11 line 62 through Col. 12 line 23); wherein the steps of performing image detail enhancement further includes the steps of performing image detail enhancement on the image pixels based on the adjusted gain factors to selectively reduce enhancement of the detected image pixels in the luminance transition range of the edge (Col. 19 lines 10-32).

Therefore, in view of Nagao, it would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify Ott et al. and Hannah by incorporating the method steps of selecting enhancement gain factors, as taught by Nagao, wherein the scaling coefficient is chosen based on the degree of enhancement desired, combining the enhancement gain factors with the gain suppression factors and performing the detail enhancement on the detected image pixels of the luminance transition range of the edge, as taught by Ott et al., based on the enhancement gain factors and gain suppression factors in order to enhance the edge region in sharpness

and the other regions no edge enhancement is performed, but the noise component can be eliminated (Col. 19 lines 10-32).

As to claims 3 and 17, Ott et al. further teaches detecting a luminance transition range of the edge and a center pixel of the luminance transition range (Col. 6 lines 7-22 and line 64 through Col. 7 line 19).

5. Claims 11, 12, 25 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ott et al. in view of Hannah as applied to claims 2 and 16 above, and further in view of Takamori (US 6,252,995). The teachings of Ott et al. modified by Hannah have been discussed above.

As to claims 11 and 25, Ott et al. modified by Hannah fails to teach performing a low pass filter function on the image signal *f* to generate an unsharp image signal f_1; determining the difference between the original image signal *f* and the unsharp signal f_1, as a different signal, wherein said difference signal represents image details; selectively boosting the difference signal such that enhancement of the difference signal at the detected pixel locations is reduced relatively to enhancement of other image pixels based on the gain suppression factors; and adding the boosted signal to the original signal to obtain a detail enhanced image signal *g*.

Takamori teaches performing a low pass filter function on the image signal *f* ("input image signal S") to generate an unsharp image signal f_1 (FIG. 2, "unsharp signal generator **24**, unsharp signal U", Col. 1 lines 15-27 and Col. 3 lines 23-26); determining

the difference between the original image signal *f* and the unsharp signal f_1, as a different signal, wherein said difference signal represents image details (FIG. 2, "subtractor **26**, unsharp masking signal S-U", Col. 4 lines 28-37); selectively boosting the difference signal ("sharpness enhancement coefficient k") such that enhancement of the difference signal at the detected pixel locations is reduced relatively to enhancement of other image pixels based on the gain suppression factors (FIG. 2, "multiplier **50**", Col. 4 lines 38-41); and adding the boosted signal to the original signal to obtain a detail enhanced image signal (FIG. 2, "adder **28**", Col. 4 lines 46-52).

As to claims 12 and 26, Takamori further teaches the enhanced image signal *g* ("sharpness-enhance signal S**") is related to the original image signal *f* ("input image signal S") as: $g = (f - f1)*K*\alpha + f$ wherein: $(f - f1)$ is the difference signal ("unsahrp masking signal (S-U)"), *K* is the enhancement gain factor for the pixel ("enhancement coefficient h"), and α is the gain suppression factor for the pixel ("sharpness enhancement coefficient k", Col. 3 line 23 through Col. 4 line 52).

Therefore, in view of Takamori, it would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify Ott et al. and Hannah by incorporating the unsharp signal generator, which generates an unsharp signal based on an arithmetic mean of a signal (Col. 1 lines 15-27), the subtractor, which generates a difference signal between the original signal and the unsharp signal, and boosting the signal with the gain parameters, as taught by Hannah, and the enhancement factor, as taught by Takamori, in order to provide a method and a system

for enhancing the sharpness of images having small contrast such as of texture without enhancing uniform density regions to a granular state and also without enhancing quantized steps (Col. 1 lines 63-67).

6. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ott et al. in view of Hannah as applied to claim 1 above, and further in view of Furusawa et al. (US 5,050,227). The teachings of Ott et al. modified by Hannah have been discussed above.

As to claim 13, Ott et al. modified by Hannah fails to teach the step of detecting image pixels that belong to an image edge, further includes the steps of detecting image pixels that belong to a slant edge.

Furusawa et al. teaches the step of detecting image pixels that belong to an image edge, further includes the steps of detecting image pixels that belong to a slant edge (Col. 5 lines 43-55 and Col. 7 lines 1-31).

Therefore, in view of Furusawa et al., it would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify Ott et al. and Hannah by incorporating the method step of detecting a contour and its direction in order to select a smoothing/enhancing filter based on the direction of the contour (Col. 5 line 56 through Col. 6 line 4).

Allowable Subject Matter

7. Claims 4-10, 14, 18-24 and 27-28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: the closest prior art made of record fails to teach or suggest the generation a gain suppression factor based on pixel position, the enhancement gain factor, and the contrast of the luminance transition range. Also, the gain suppression scheme as claimed, wherein the gain is suppressed more for the center pixel of the range and suppressing less for those away from the center, and where no gain suppression is performed for pixels outside the transition range.

The prior art also fails to teach the gain suppression factor generation as claimed in claims 7-10 and 21-24, and the determination of the length and center pixel of the luminance transition region for the gain suppression of the enhancement in the image region.

Response to Arguments

Objections to the Specification

8. Page 12, lines 9-10 has been amended to recite "Transition Range of Slant Image Edges," pending patent application " by Xiangling Wang and Yeong-Taeg Kim, attorney" to correct sentence grammar. Therefore, the objection has been removed.

Page 22, line 22 has been amended to recite "processor, as logic circuits, as Application Specific Integrated Circuit (ASIC), as firmware, etc., as" to define the term ASIC. Therefore, the objection has been removed.

Claim Objections

9. Claim 11, line 7 has been amended to recite "as a different signal" to further define the signal representing the difference between the original image *f* and the unsharp signal f_1. Therefore, the objections for claims 11 and 12 have been removed.

Claim Rejections under 35 U.S.C. § 112

10. Claims 14 and 27 have been amended to recite "mean value" instead of "variance value" in order to comply with the written description required by 35 U.S.C. § 112 first paragraph. Therefore, the rejections have been removed.

11. Claim 1, line 3 has been amended to recite "a luminance transition range" in order to provide proper antecedent basis for this limitation in claim 3. Therefore, the rejections on claims 3-10 have been removed.

Claim 17, line 2 has been amended to recite "a luminance transition range" in order to provide proper antecedent basis for this limitation in the claim. Therefore, the rejections on claims 17, 18 and 21-24 have been removed.

Claim 19, has been amended to depend upon claim 17 in order to provide proper antecedent basis for the claim limitation "the luminance transition range". Therefore, the claims rejections on claims 19 and 20 have been removed.

Claim 25, line 2 has been amended to recite "the original image signal at a detected pixel" in order to provide proper antecedent basis for this limitation. .Therefore, the rejections on claims 25 and 26 have been removed.

Claim Rejections under 35 U.S.C. § 102

12. Applicant's arguments with respect to claims 1-4 and 15-18 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections under 35 U.S.C. § 103

13. Applicant's arguments with respect to claims 5, 6, 11-14, 19, 20, 25 and 27 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Kim disclose a Method for Enhancing a Digital Image While Suppressing Undershoots and Overshoots, LaRossa et al. disclose a Digital Image Processing Method for Edge Sharpening, Lee disclose an Automatic Tone Adjustment by Contrast Gain-Control on Edges, and Szymaniak disclose a Method and Apparatus for Eliminating Unwanted Steps at Edges in Graphics Representations in the Line Raster.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jose M. Torres whose telephone number is 571-270-1356. The examiner can normally be reached on Monday thru Friday: 8:00am - 4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jingge Wu can be reached on 571-272-7429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JMT
06/08/2007

JINGGE WU
SUPERVISORY PATENT EXAMINER